UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/566,389	05/26/2006	Abdulsalam Al-Mayahi	663073607	3744

25269 7590 10/08/2009

DYKEMA GOSSETT PLLC
FRANKLIN SQUARE, THIRD FLOOR WEST
1300 I STREET, NW
WASHINGTON, DC 20005

EXAMINER	
FORTUNA, ANA M	

ART UNIT	PAPER NUMBER
1797	

MAIL DATE	DELIVERY MODE
10/08/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/566,389	AL-MAYAHI ET AL.	
	Examiner	Art Unit	
	ANA M. FORTUNA	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 August 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *42-58* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *42-58* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 42, 43, 44, 45, 46-51, 52, 53, 54, 55, 57, 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 97/18166 (hereinafter WO '166) in view of Lefebvre (US 4,781,837), Mickols (US 5,755,964), and further in view of Herron et al (US 5,281,430). Publication WO'166 discloses a process for removing solvent, e.g. water, from saline water, such a brackish water, gray water, sea water etc. The process include the steps of disposing the solution to be treated at one side of a semi-permeable hydrophilic membrane, and disposing a second solution having a higher osmotic potential, e.g. salt brine (abstract, Figs. 1 and 6; page 3, lie 11-page 4, line 30). Solvent (water) passes across the membrane, diluting the second solution during the process; the second solution is further concentrated by removing water by reverse osmosis, evaporation, or combination (abstract, step b). The membrane can be a thin film composite hydrophilic membrane in different configurations (page. 11, third paragraph). The use of nanofiltration in the concentration step (b) is not disclosed in this reference (WO'166).

Patent '837 teaches combining osmotic separation using a concentrate salt solution and a hydrophobic membrane and concentration the diluted concentrate solution by a reverse osmosis membrane and recirculating the concentrate salt solution back to the

process (abstract, column 2, lines 38-column 3, line 20; column 4-colum 5, line 26). Patent does not teach “nanofiltration”, however, teaches the bases for membrane selection and membrane salt combination; the reference suggests the use of more open membranes to concentrate the osmotic (concentrate solution) that has been dilute and recycle back to the process; the membrane can have a larger pore size but has to be capable or retaining the large anion, or charged membrane capable of retaining hydrogen ions and anions of any size (column 11, lines 15-27).

Based on these teachings, it would have been obvious to one skilled in this art at the time this invention was made to substitute the reverse osmosis membrane in the process of WO’166, by a nanofiltration membrane, which is known to retain divalent salts from the high osmotic potential solution, or brine salt. It would have been obvious to one skilled in this art at the time the invention was made to predict the retention or magnesium sulfate or sodium sulfate, as in claim 7 of the present invention, by using a nanofiltration, base on the membrane retention of divalent ions.

Patent ‘964 is further cumulative and teaches use of nanofiltration membrane and its retention of divalent ions and organic compounds, such as glucose retention (column 1, lines 32-37, and column 3, lines 41-53). Further advantages of using nanofiltration, such a high flux and lower pressure requirements are disclosed in this patent (column 2, second paragraph). As to claim 58, using more that one membrane in series is cumulative for achieving higher concentrations of the second solution, if the membranes are connected in concentrate series.

As to the pressure of operating of the nanofiltration membrane, the skilled in the art at the time this invention was made would have been motivated to adjust pressure based on requirements, e.g. depending on feed concentration, to be able to overcome the osmotic pressure, and maintain the pressure within the levels suggested by the manufactures of the membrane, to avoid membrane breakage.

It would have been further obvious to one skilled in this art at the time this invention was made to use nanofiltration membranes to concentrate the concentrate solution or high osmotic potential solution to reduce the pressure requirements during the concentration and increase flux, and more particularly to retaining any divalent ions present in the second solution, to produce water with an adjusted monovalent content as product from the nanofiltration stage.

As to claims 45, and 53-54, the nanofiltration pore size is lower than 10 nanometers (between RO and ultrafiltration) therefore the membrane will retain any particle having a size of 10 nanometers or greater. Regarding claim 58, the use of more than one nanofiltration membranes is considered to be cumulative.

Adjusting the amount of salt in the second solution to keep the higher osmotic potential, e.g. to allow the diving force to direct the solvent across the membrane to the second solution is required in order to perform the solvent separation during the process.

Regarding claims 46-49, publication WO'166 teaches combining membrane concentration with evaporation (abstract, page 2, lines 27-34, and page 4, lines 15-30). The specific evaporation methods are not disclosed in WO'166, but are covered by the term "thermal evaporation (page 2, line 30).

Regarding claim 57, the term "up to" includes lower ranges of temperatures that includes zero. The temperature claimed can be assume to be ambient temperature, or can be temperatures generated by the salts addition.

It would have been obvious to one skilled in the art at the time this invention was made to select any of the conventional methods of thermal evaporation for concentrating to reach to higher concentrations of the osmotic solution, based on the suggestion of combining both, the membrane step and evaporation.

As discussed above, the solvent in the first solution is water, and the solvent in the second solution is a "brine solution", containing divalent salts (WO'166, page 3, lies 13-34).

The references discussed above lack the antifouing or antiscaling agents. Patent '430 teaches cleaning the membrane in an osmotic membrane separation process, by using antiscale or antifoaming agent, to remove residues from the membrane in the side where the osmotic agent is provided; Ultrasil (column 14, example 4). The patent does not provide the agent in the osmotic solution. The skilled in this art at the time this invention was made at the time this invention was made was able to predict the improvement in membrane cleaning by providing the agent (antifouling agent) within the concentrate solution, e.g cleaning and protecting the membrane in operation.

3. Claims 42, 43, 44, 45, 52-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yaeli (US 5,098,575) in view of Mickols (US 5,755,964), Lefebvre (US4,782,837), and further in view of Herron et al (US 5,281,430). Yaeli discloses a

process of purifying seawater by combining natural osmosis and reverse osmosis, e.g. the step of concentration of the second solution is performed in a reverse osmosis membrane, which has inherent pore sized within the lower pore size range claimed (see abstract, figure, and column 3, lines 15 through column 4, line 44). Using a nanofiltration membrane in step b), to concentrate the dilute solution is not disclosed in the patent. Patent '964 discloses the properties of nanofiltration membranes and its divalent ion rejection, low pressure operation and high membrane flux as compared to the reverse osmosis membrane, as discussed in the paragraphs above. Patent '837, also discussed above teaches combining osmotic distillation and reverse osmosis and suggests using membranes of higher pore size to concentrate the osmotic solution containing magnesium sulfate, as discussed in the paragraphs above. It would have been obvious to one skilled in this art at the time this invention was made to substitute the reverse osmosis membrane in Yaeli, by a nanofiltration membrane, e.g. to increase the flux, reduce operational costs by reducing the pressure applied to the membrane separation, and retain the osmotic agent in the osmotic solution, since nanofiltration membranes retain sugar molecules, in addition to divalent ions, as disclosed in '964.
As to claim 42-43, the retention of particles or components with sizes as claimed are inherent of the membrane, based on the nanofiltration membrane molecular weight cut-off.

As to claims 46-48, concentrating the diluted second solution by evaporation is disclosed in patent '430, therefore, further combining reverse osmosis and evaporation

to further concentrate the osmotic agent solution would have been obvious to the skilled artisan.

Patent '430 teaches cleaning the membrane in an osmotic membrane separation process, by using antiscale or antifoaming agent, to remove residues from the membrane in the side where the osmotic agent is provided; Ultrasil (column 14, example 4). The patent does not provide the agent in the osmotic solution. The skilled in this art at the time this invention was made at the time this invention was made was able to predict the improvement in membrane cleaning by providing the agent (antifouling agent) within the concentrate solution, e.g cleaning the membrane in operation, or agents protecting the membrane from becoming clogged.

4. Applicant's arguments filed 11/24/08 have been fully considered but they are not persuasive. Claim 42 includes pressure limitations of "at least 7MPA. The later tem does not exclude higher pressures, as high as the temperatures used in reverse osmosis processes; and also includes ranges of low pressure which covers the suggested operating pressures for commercial nanofiltration membranes, the skilled in the art at the time this invention was made would have been motivated to adjust pressure based on requirements, e.g. depending on feed concentration, to be able to overcome the osmotic pressure, while maintaining the recommended operating pressures for the membrane. Patent US 6,508,936 s cited as evidence of operating pressures for NF, and teaches operating NF membranes at 70 bars (7Mpa).

Applicant argues that monovalent salts are "preferred" in the prior art (WO'166), however, divalent salts are also suggested, and the invention is not limited to preferred embodiments.

The retention of multivalent ions by nanofiltration membranes is discussed in the office action, and well known in the art of desalination and water softening, which is supported by the references above. The skilled artisan at the time this invention was made can predict the rejection of these salts and/or sugars by nanofiltration, based on membrane pore size, inherent charge and selectivity. Applicant argues that in reference WO'166 the solution is reclaimed by reverse osmosis and that there is not disclosure of nanofiltration. Mickols teaches a membrane with the properties as in the membrane used in the current process and its performance for monovalent divalent salts separation, therefore, the retention of the salts used in the this process, which include divalent salts of magnesium, is predictable by the skilled artisan at the time this invention was made. Patent '837 does not mention "nanofiltration" by name, however, suggests selecting a membrane capable of retaining large ions, and charged membranes. The term "large ions" is assumed to be directed to multivalent ions, which are known to be retained by nanofiltration membranes. The membrane selection in the separation of the second solution is obviously determined based on the purity of the solution required and the particular salt and/or sugar recovered from the second solution. Reverse osmosis produces water of higher purity as compared to the water produced by nanofiltration, which permeates monovalent ions. It would have been obvious to one skilled artisan at the time this invention was made to tailor the process to

recover water of a predetermined quality, or softened water by substituting the reverse osmosis step by a nanofiltration step. The results when substituting the RO by a NF membrane can be predicted by the skilled artisan in terms of the membrane high rejection for divalent ions, and low retention of monovalent ions.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, patent 5755964 provides motivation to use nanofiltration membrane for softening water at a faster rate due to the higher membrane flux as compared to nanofiltration membrane and the membrane separation of divalent ions, such as magnesium (column 1, lines 10-55).

Response to Arguments

Applicant's arguments filed 8/31/09 have been fully considered but they are not persuasive. Applicant argues that the salts used in the second solution are not capable of clogging the membrane and therefore there is not motivation of adding antiscale and biocide agents to the second solution. The agents can be added before the membrane, and since the concentrate is recirculated back to the second solution some of the retained agents may be present in the second solution; independently to the point where the agents are added they are maintained in the retentate conduit circuit, and

when the salts pas at the membrane feed space this agents protect the membrane and facilitate better performance, as expected by the skilled artisan. Applicant has not provided any unexpected results as consequence of adding the particular agents in the second solution. The claims as amended are a combination of the previously rejected claims, the action above is rearranged and maintained.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ana M. Fortuna whose telephone number is (571) 272-1141. The examiner can normally be reached on 9:30-6:00 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David R. Sample can be reached on (571) 272-1376. The fax phone

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ana Fortuna/
Primary Examiner, A. U. 1723

/Ana M Fortuna/

Primary Examiner, Art Unit 1797